

REMARKS

Reexamination and reconsideration of the application as amended are requested. It is noted that amended claim 1 now contains the limitations of canceled claim 11 with "reference" being substituted for "calibration". Claims 9-11 have been canceled.

The examiner's rejection of claims 1-24 as "indefinite", under 35 U.S.C. 112, is respectfully traversed. Applicants have changed "calibration signal" to "reference signal" and have changed "calibration signals" to "reference signals" as suggested by the examiner.

The examiner's rejection of claims 1-3, 5, 8, 12-18, and 20-24 as "anticipated", under 35 U.S.C. 102, is respectfully traversed. The examiner rejects these claims as being unpatentable over O'Donnell (US 5,453,575). Claims 2-3, 5, 8, 12-18 and 20 depend from claim 1, and claims 22-24 depend from claim 21.

Claim 1 requires receiving at least two reference signals of imaging ultrasound waves that have been reflected from different regions in the anatomical tissue, wherein a transducer is moved such that the reference signals are reflected from different regions. This at least means moving a transducer such that a first received signal has been reflected from a first tissue region and a second received signal has been reflected from a different second tissue region. For example, and without limitation, if the transducer were disposed in the esophagus of a patient, the transducer can be pointed to the front of the patient for the first signal and can be moved and pointed to the back of the patient for the second signal. As stated in paragraph [0020] of the specification, "Ultrasound images of anatomical tissue are likely to be dominated by random speckle and there is little or no correlation between images of different tissue regions. In contrast, the electronic artifacts may remain relatively constant throughout repeated imaging over a relatively short period of time. Therefore, when the values of corresponding array elements of the image frames received at step 12 are averaged, array element values in areas of the averaged image frame containing image data from anatomical tissue will approach zero, while array element values of areas of the image frame containing artifacts will tend toward a constant, non-zero value. The most basic method of averaging consists of summing the corresponding array element values of each image frame and dividing by the number of image frames".

The waveform signals received by O'Donnell are all received from the same tissue region. O'Donnell uses the received waveform signals to attenuate the portions of the waveform signals received from the static features in the region (i.e., the patient tissue) and not from the relatively dynamic features in the same region (i.e., the blood flow). See the abstract of O'Donnell. The time between transmitting and receiving a first signal and transmitting and receiving a second signal in O'Donnell is about six millionths of a second (see column 22, lines 4-14). The number of signals used by O'Donnell is large enough to see blood flow but small enough not to see tissue move (see column 22, lines 4-27), and a patient would have no time to breathe or even blink. "The maximum time period is that in which the tissue in an imaged region of a vasulature remains in a substantially fixed position" (see column 21, lines 28-30 of O'Donnell). Thus, it can be fairly said that the waveform signals received by O'Donnell are all received from the same tissue region. Also, O'Donnell does not teach, suggest or describe moving his transducer during the maximum time period. Thus, O'Donnell teaches opposite to applicants' claim 1 which requires receiving at least two reference signals of imaging ultrasound waves that have been reflected from different regions in the anatomical tissue, wherein a transducer is moved such that the reference signals are reflected from different regions.

Claim 21 requires receiving at least two reference signals of imaging ultrasound waves that have been reflected from different regions in the anatomical tissue, and applicants' previous remarks, with respect to the patentability of claim 1 over O'Donnell that the waveform signals received by O'Donnell are all received from the same tissue region are herein incorporated by reference.

The examiner's rejection of claims 1-8 and 12-24 as "anticipated", under 35 U.S.C. 102, is respectfully traversed. The examiner rejects these claims as being unpatentable over Wu (US 6,036,650). Claims 2-8 and 2-20 depend from claim 1, and claims 22-24 depend from claim 21.

As previously stated, claim 1 requires receiving at least two reference signals of imaging ultrasound waves that have been reflected from different regions in the anatomical tissue, wherein a transducer is moved such that the reference signals are reflected from different regions. Wu does not gather one waveform and then move (reposition) his transducer to gather

another waveform. Wu states, "The invention has a number of important features and advantages. It provides a method and apparatus for ultrasonically imaging small cavities in which ringdown drift is effectively reduced in the received signal in order to reduce ringdown artifacts in the displayed image, and it does so in a way which does not require repositioning the catheter in the patient's body to gather a new reference waveform" (see column 13, lines 42-48). See also column 2, lines 37-40 of Wu). It is noted that the imaging probe of Wu is located in his catheter (see column 4, lines 1-2 of Wu).

Claim 21 requires receiving at least two reference signals of imaging ultrasound waves that have been reflected from different regions in the anatomical tissue and deriving a correction signal by weighted averaging of the reference signals, where the weighted average assigns a higher weight to reference signals that are not correlated to a prior reference signal.

Wu, in his objects and summary of the invention section of his patent, states, "These and other objects of the invention are accomplished by providing an ultrasonic imaging method and apparatus in which a reference waveform which is substantially free of echoes is modified to be equal to a weighted sum of the reference waveform and filtered signals from the transducing elements which transmit the ultrasonic waves and receive the reflected echoes. The modified waveform is then subtracted from the transducer signals to remove ringdown signals and provide a displayed image which is substantially free of ringdown artifacts" (see column 2, lines 42-51 of Wu). See also the abstract of Wu.

Wu starts with one reference waveform which is free of echoes which means it is a transmit waveform and not a reflected echo waveform. Applicants' claim 21 starts with at least two received reflected signals which is not taught, suggested, or described in Wu.

That the one reference waveform of Wu is not a received waveform is shown, for example, in column 5, lines 19-20, wherein Wu states, "... the tissue signal or echo is represented by a tissue vector ...". Also, see figure 5 and column 5, lines 56-65 of Wu, wherein Wu states, "The ringdown artifact looks like a corona surrounding the perimeter of the probe. The imaging probe is blind within the corona because any echo information superimposed on the ringdown signal is substantially lost because the ringdown signal saturates the receiving

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amplifiers". This supports applicants' assertion that a signal free of echoes in Wu is not a received signal.

The examiner's rejection of claim 4 as "obvious", under 35 U.S.C. 103, is respectfully traversed. The examiner rejects this claim as being unpatentable over O'Donnell in view of Phillips (US 6,632,177). Claim 4 depends from claim 1, and applicants' previous remarks concerning the patentability of claim 1 over O'Donnell are herein incorporated by reference.

The examiner's rejection of claim 7 as "obvious", under 35 U.S.C. 103, is respectfully traversed. The examiner rejects this claim as being unpatentable over Wu in view of Hassler (US 5,245,586). Claim 7 depends from claim 1, and applicants' previous remarks concerning the patentability of claim 1 over Wu are herein incorporated by reference.

Inasmuch as each of the rejections has been answered by the above remarks and amended claims, it is respectfully requested that the rejections be withdrawn, and that this application be passed to issue.

Respectfully submitted,

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